

NOTES ON THE BIOLOGY OF METEORUS
HYPOPHLOEI CUSHM.
(Hymenoptera—Braconidae.)

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Muesebeck,² in his revision of the genus *Meteorus* Haliday, states that the species comprising this group are parasitic chiefly on lepidopterous larvae. *M. humilis* (Cress.), he adds, has been recorded as being parasitic on the coleopterous larva *Platydemia ellipticum* Fabr., a tenebrionid, and *Orchesia castanea* Melsh., a melandryid. He says, however, that the determinations of the hosts were somewhat doubtful, and that definite records are needed to establish this supposedly anomalous habit of some of the members of this genus. As a tenebrionid host for a species of this genus was definitely determined, and as the habits and seasonal history of *hypophloei* differ somewhat from those of other species of *Meteorus*, the following notes are recorded, though the seasonal history was not studied in detail. For more complete accounts of the biology and morphology of species of this genus Muesebeck³ and Parker⁴ should be consulted.

The observations on *M. hypophloei* were made while a study of the parasites and predators of the mountain pine beetle (*Dendroctonus monticolae* Hopk.) attacking western white pine (*Pinus monticola* Dougl.) was being conducted. The study was made near Metaline Falls, Washington, on the Kaniksu National Forest, which is in the extreme northeast corner of the state.

Acknowledgment is made to Mr. R. A. Cushman, of the taxonomic unit of the U. S. Bureau of Entomology, for the determination of this species, which he has recently described.⁵

¹ Resigned May, 1931.

² Muesebeck, C. F. W. A Revision of the North American Species of Ichneumon-Flies Belonging to the Genus *Meteorus* Haliday. Proc. U. S. National Museum 63: Art. 2, 1923. Washington, D. C.

³ Muesebeck, C. R. W. Two important introduced parasites of the brown-tail moth. Jour. Agr. Res. 14: 191-206, 1918.

⁴ Parker, H. L. Notes on *Meteorus* (*Zemiotes*) *nigricollis* Thomson, an occasional parasite of the European Corn Borer. Proc. Ent. Soc. Wash. 33: 93-103, 1931.

⁵ Cushman, R. A. Three new Braconidae parasitic on bark-beetles. Jour. Wash. Acad. Sc. 21: 301-304, 1931.

SEASONAL HISTORY AND HABITS

While subcortical insects associated with the mountain pine beetle were being looked for, yellowish cocoons were frequently found in the egg galleries of the beetle. The cocoons occurred both in trees which contained the brood of the beetle and in those from which the brood of the beetle had emerged. Alongside many of the cocoons, or affixed to them, were the collapsed larval skins of a species of *Hypophloeus*. The most abundant species of the genus found under the bark of trees killed by the mountain pine beetle was *H. parallelus* Melsh., and it is certain that many, if not all, of the skins belonged to the larvae of this species.

Some cocoons were found the first day of the field season, April 25, 1930. Of eight cocoons examined, seven contained larvae and one an adult. The adult was dead but rather moist, and appeared as though it had recently transformed. Five of the cocoons were saved for rearing and from these two males emerged between May 9 and 11 and one female between May 11 and 12. The female was fed sugar water, and though it remained alive until May 29, it would not oviposit on any *Hypophloeus* larvae. Two more cocoons were collected May 19; a male emerged from one between May 22 and 26 and a female from the other May 27. Though the female was fertilized by the male as soon as both were placed together, she refused to oviposit on the *Hypophloeus* larvae placed with her, and died on June 5. The male died May 30. Later, the larvae of *Dendroctonus monticolae*, a species of *Hypophloeus*, and a species of *Rhizophagus* (a small subcortical larva similar in size and shape to a *Hypophloeus* larva) were secured and placed with several females of *Meteorus* that had been collected in the field. However, none of these would oviposit on the larvae nor would they pay any attention to them.

About two months later an attempt at oviposition was observed. Three *Hypophloeus* larvae and a female *Meteorus* had been placed in a Syracuse watch glass, the bottom of which had been covered with paper to give footing to the insects. The braconid sensed immediately the presence of the larvae. She ran up to one of them and rapidly, almost feverishly, vibrated her antennae over its dorsal surface, and at times felt the surface first with one antenna and then with the other. The larva during this time continued to move rapidly around the edge of the paper, and the female kept abreast of it by moving sidewise. Suddenly, still facing the larva, she bent her abdomen forward between her legs and

attempted to pierce its venter with her ovipositor, but the larva gave a sudden twist and apparently "scared" her off.

Subsequently, under the same conditions, females were observed to oviposit many times in *Hypophloeus* larvae. Each time before oviposition they went through the same maneuvers described above. Oviposition occurred in previously parasitized as frequently as in apparently unparasitized larvae. In the field, however, only one parasitic larva was found to emerge from its host at maturity. Females would not oviposit in dead *Hypophloeus* larvae, or in larvae which were not moving. Though the parasite would become excited and dash up to an inactive larva, she lost interest immediately if it did not begin to move when it was touched with her antennae.

The parasite inserts her ovipositor in any portion of the venter of the larva, but most often, it appeared, in the region of the first abdominal segment. Larvae that had been punctured as many as six times showed no ill effects from the operation at any period. The act of oviposition required usually no more than a second, though occasionally, when the female had difficulty in extracting her terebra, it took a second or two longer. It was not determined whether or not the parasite selects larvae of a certain instar.

Eight active and apparently normal and full-grown *Hypophloeus* larvae were collected August 18 and placed in a vial for rearing. Between August 29 and 30 one parasitic larva emerged from one of the larvae of the beetle, but before a cocoon could be spun by the larva of the parasite it was fed on by one of the remaining beetle larvae. The larval skin of the parasitized tenebrionid was in the characteristic deflated form.

Meteorus adults (Pl. IV) were observed on certain trees from about the middle of June up to the end of the first season, September 23. They were especially common about the middle of July on one tree and the forepart of September on another. Both trees had been attacked by the mountain pine beetle the previous year, and *Hypophloeus* larvae were fairly abundant beneath the bark of each. On other trees, attacked the same season, no *Meteorus* adults were found, and in these trees the tenebrionid larvae seemed as abundant as in the other two.

The adults are very active, though when disturbed they usually escape by running rather than by flying. They work over the tree apparently in search of *Hypophloeus* larvae, crawling on the surface of the bark. None of the parasites had been observed under the bark in the egg galleries of the mountain pine beetle.

The egg is practically colorless. Its surface is smooth and

resembles a soap bubble in appearance. It is oval in shape, with a slight, nipple-like projection at one end. At the opposite end it is drawn out into a tapered stalk about one-third as long as its main portion. The eggs dissected from the *Hypophloeus* larvae averaged slightly over 0.35 mm. in length and 0.1 mm. in width.

The incubation period, though not definitely determined, probably occupies more than one day but less than five. A larva which was dissected twenty-four hours after it was parasitized still contained the egg unhatched; another larva dissected 116 hours after it was parasitized contained a larva 1.25 mm. in length.

The larva observed was of the caudate type. The head occupied about three-twentieths of the length of the body; the tail-like segment, four-twentieths. The mandibles were indistinct but appeared to be set far apart and were slightly sclerotized. The tail-like segment bore numerous rather coarse spines, which appeared to be more numerous on the dorsal surface. These were not visible on the other body segments. The first-instar larva of *Meteorus nigricollis* lacks these spines (Parker, *op. cit.*). The full-grown larva is hymenopteriform and averages about 4.5 mm. in length. The head capsule bears the same type of sclerotized design in the buccal region that is found on other full-grown braconid larvae, and numerous very minute spines are present on all the body segments.

The pupal stadium was not determined, and the pupal stage not observed.

Adults of the species were collected in Montana also. A female was reared from a cocoon collected under the bark of lodgepole pine infested with the mountain pine beetle near Sula. The cocoon was collected May 24, 1929, and the adult emerged between June 6 and 7, 1929. Several adults were also collected in August on the bark of trees infested the previous year, and on trees recently infested. No other information was secured regarding its biology in this locality.

SUMMARY.

(1) *Meteorus hypophloeï* Cushm. is a primary, internal, solitary parasite of the larvae of *Hypophloeus parallelus* Melsh. and probably other associated *Hypophloeus* larvae in northeastern Washington and southwestern Montana.

(2) Adults were reared in May from the cocoons collected the latter part of April, but no parasitism of the larvae of *Hypophloeus* could be secured until August. There is probably but one

generation a year, the parasite overwintering in the larval stage within a cocoon.

(3) Larvae of the parasite emerged from *Hypophloeus* larvae in August.

(4) The egg, first-instar larva, and full-grown larva are briefly described, but the full seasonal history was not determined.

Calosoma Escaping by Diving.—Reading the “Touching Tale of the Quaking Quag” by Mr. Frost in the October BULLETIN reminded me of another case in which a beetle was observed to seek safety under water. One summer day several years ago, while sitting on a boulder on the beach of Northern Lake Michigan waiting for a boat to pick me up, I idly turned over the stones within reach to see what had taken shelter beneath them. From under one darted a specimen of *Calosoma calidum*, and in its haste to escape appeared to fall into the water filled cavity from which a deeply embedded stone had been removed. As the beetle failed to appear on the surface after several minutes, with my fingers I explored the muddy water which was several inches deep, and found it under a small stone on the bottom. When released on the beach it immediately darted back into the same cavity. For nineteen minutes by my watch I waited but it did not come to the surface. My boat had then arrived, but before leaving I again retrieved the beetle which seemed none the worse for its submersion, and when released, for the third time again sought its underwater retreat.—SHERMAN MOORE, Detroit, Michigan.

Records of Connecticut Heteroptera.—On August 10, 1931, I spent an hour or so on the shores of Lake Candlewood, in Connecticut, some ten miles from Danbury. This is an artificial body of water, for power production; it consists largely of drowned valleys and has a periphery of some thirty miles of shore line. The growth swept was the usual Eastern summer vegetation of this latitude—grasses, *Daucus carota*, *Asclepias*, *Rubus* spp., etc. The bugs taken in ones and twos (all new records for the State), were: *Corimelaena pulicaria* Germ., *Neottiglossa undata* Say, *Mormidea lugens* Fabr., *Orsillus scolopax* Say, *Zeridoneus costalis* Van Duzee, *Nabis subcoleoptratus* Kirby, *Sinea diadema* Fabr., *Phymata erosa* Wolff, and *Miris dolabratus* Linne.—J. R. DE LA TORRE-BUENO, White Plains, N. Y.